

WHAT WE CLAIM IS:

1. A method of measuring the thickness of an insulator film formed on one surface of a semiconductor substrate, in a non-contact manner with respect to the insulator film,
5 comprising:

a charging processing step of charging the insulator film surface in a non-contact manner;

a charge amount measuring step comprising: a step of obtaining a first flat band voltage by conducting, prior to the
10 charging processing step, a C-V measurement on the semiconductor substrate in a non-contact manner with respect to the insulator film; a step of obtaining a second flat band voltage by conducting, after the charging processing step, a C-V measurement on the semiconductor substrate in a non-contact manner with respect
15 to the insulator film; and a step of calculating, based on a difference between the first and second flat band voltages, the charge amount given to the insulator film surface by the charging processing step;

a surface potential measuring step of measuring, after
20 the charging processing step, the insulator film surface potential in a non-contact manner with respect to the insulator film; and

a step of calculating the insulator film thickness based on the charge amount measured at the charge amount measuring
25 step and on the surface potential measured at the surface

potential measuring step.

2. A thickness measuring method according to Claim 1,
wherein the charging processing step comprises a step of charging
5 the insulator film surface by corona discharge.

3. A thickness measuring method according to Claim 1,
wherein the charging processing step comprises a step of
irradiating, onto the semiconductor substrate, ultraviolet rays
10 having a wavelength of not less than 220 nm and not greater than
300 nm.

4. A method of measuring the relative dielectric constant
of an insulator film formed on one surface of a semiconductor
15 substrate, in a non-contact manner with respect to the insulator
film, comprising:

a charging processing step of charging the insulator film
surface in a non-contact manner;

a charge amount measuring step comprising: a step of
20 obtaining a first flat band voltage by conducting, prior to the
charging processing step, a C-V measurement on the semiconductor
substrate in a non-contact manner with respect to the insulator
film; a step of obtaining a second flat band voltage by conducting,
after the charging processing step, a C-V measurement on the
25 semiconductor substrate in a non-contact manner with respect

to the insulator film; and a step of calculating, based on a difference between the first and second flat band voltages, the charge amount given to the insulator film surface by the charging processing step;

5 a surface potential measuring step of measuring, after the charging processing step, the insulator film surface potential in a non-contact manner with respect to the insulator film; and

 a step of calculating the insulator film relative
10 dielectric constant based on the charge amount measured at the charge amount measuring step and on the surface potential measured at the surface potential measuring step.

5. A relative dielectric constant measuring method
15 according to Claim 4, wherein the charging processing step comprises a step of charging the insulator film surface by corona discharge.

6. A relative dielectric constant measuring method
20 according to Claim 4, wherein the charging processing step comprises a step of irradiating, onto the semiconductor substrate, ultraviolet rays having a wavelength of not less than 220 nm and not greater than 300 nm.

25 7. A thickness measuring apparatus for measuring the

thickness of an insulator film formed on one surface of a semiconductor substrate, in a non-contact manner with respect to the insulator film, comprising:

(i) a charging processing unit for charging the insulator
5 film surface in a non-contact manner;

(ii) a charge amount measuring unit for measuring, in a non-contact manner with respect to the insulator film, the charge amount given to the insulator film surface by the charging processing unit,

10 this charge amount measuring unit comprising:

a contact electrode arranged to come in contact with the other surface of the semiconductor substrate;

a measuring electrode arranged to be opposite to, as separated from, the one surface of the semiconductor substrate
15 of which the other surface contacts with the contact electrode;

a gap measuring mechanism for measuring the gap between the semiconductor substrate and the measuring electrode;

a gap changing mechanism for changing the gap between the semiconductor substrate and the measuring electrode;

20 a bias voltage applying unit for applying a bias voltage between the contact electrode and the measuring electrode, this bias voltage applying unit being capable of changing the magnitude of the bias voltage to be applied; and

a capacitance measuring unit for measuring the electric
25 capacitance between the contact electrode and the measuring

electrode; and

(iii) a surface potential measuring unit for measuring the insulator film surface potential in a non-contact manner with respect to the insulator film.

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8. A thickness measuring apparatus according to Claim 7, wherein the charging processing unit comprises a corona discharging unit for generating corona discharge on the insulator film surface.

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9. A thickness measuring apparatus according to Claim 7, wherein the charging processing unit comprises an ultraviolet ray irradiation unit for irradiating ultraviolet rays onto the surface of the insulator film.

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10. A relative dielectric constant measuring apparatus for measuring the relative dielectric constant of an insulator film formed on one surface of a semiconductor substrate, in a non-contact manner with respect to the insulator film,

20 comprising:

(i) a charging processing unit for charging the insulator film surface in a non-contact manner;

(ii) a charge amount measuring unit for measuring, in a non-contact manner with respect to the insulator film, the charge amount given to the insulator film surface by the charging

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processing unit,

 this charge amount measuring unit comprising:

 a contact electrode arranged to come in contact with the other surface of the semiconductor substrate;

5 a measuring electrode arranged to be opposite to, as separated from, the one surface of the semiconductor substrate of which the other surface contacts with the contact electrode;

 a gap measuring mechanism for measuring the gap between the semiconductor substrate and the measuring electrode;

10 a gap changing mechanism for changing the gap between the semiconductor substrate and the measuring electrode;

 a bias voltage applying unit for applying a bias voltage between the contact electrode and the measuring electrode, this bias voltage applying unit being capable of changing the
15 magnitude of the bias voltage to be applied; and

 a capacitance measuring unit for measuring the electric capacitance between the contact electrode and the measuring electrode; and

 (iii) a surface potential measuring unit for measuring the
20 insulator film surface potential in a non-contact manner with respect to the insulator film.

11. A relative dielectric constant measuring apparatus according to Claim 10, wherein the charging processing unit
25 comprises a corona discharging unit for generating corona

discharge on the insulator film surface.

12. A relative dielectric constant measuring apparatus according to Claim 10, wherein the charging processing unit
5 comprises an ultraviolet ray irradiation unit for irradiating ultraviolet rays onto the semiconductor substrate.